Space Weather Technical Forecast

Issued on Thursday, 02 November 2023 at 01:09 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of further M-class flares throughout. Chance of Active fluence 02-03 Nov.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Moderate with a peak flare of M1.4 at 01/1226 UTC. This is speculated to be from a region just beyond the southeast limb. AR3474 in the southwest remains the largest region on the visible disc. It contained a very small delta spot, but this appears to have now faded. AR3472 in the northwest continues to see the proliferation of its numerous small spots, but remains largely inactive. AR3473 and AR3474 near centre disc are largely unchanged and inactive. A newly numbered (AR3477) large sunspot region has rotated over the southeast limb, with a notable lead spot and small trailer. The region is moderately active with some C-class flaring. A small unipolar region has rotated over the northeast limb, but has not produced any significant flares so far. This region has recently been numbered AR3478. A filament eruption from the southeast quadrant around 31/2200 UTC has been analysed, with a glancing blow possible at Earth either late on day 3 (04 Nov) or early day 4 (05 Nov). No other Earth-directed CMEs have been observed in coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar wind speeds observed at L1 continue to decline, as the high speed stream from coronal hole 66 moves towards the western limb, ranging between 490-440km/s by the end of the period. Density has been below average. Total magnetic field strength, Bt, has been consistently weak, with the north-south component, Bz, also varying weakly. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was mostly Quiet throughout.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux has varied between Moderate and High levels, with a peak of 2120 pfu at 31/1710 UTC. The associated 24-hour fluence remains just below the Active (1e8 integrated pfu) threshold, reaching 8.5e7 integrated pfu at 02/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate solar activity is expected, with a chance of further isolated M-class flares.

Solar Wind / Geomagnetic Activity: A CME that left the Sun late on 31 Oct may give Earth a glancing blow either late day 3 (04 Nov) or early day 4 (05 Nov). Otherwise no other CMEs currently feature in the forecast period. The high speed stream from coronal Hole 66 continues to slowly wane, with solar winds easing from slightly elevated levels to background in the next couple of days. No further enhancements are expected during the period. Geomagnetic activity is expected to be mostly Quiet, with a chance of isolated Unsettled intervals. Any potential arrival of the CME from 31 Oct could see activity increase to Unsettled to Active levels late on day 3 (04 Nov) and day 4 (04 Nov).

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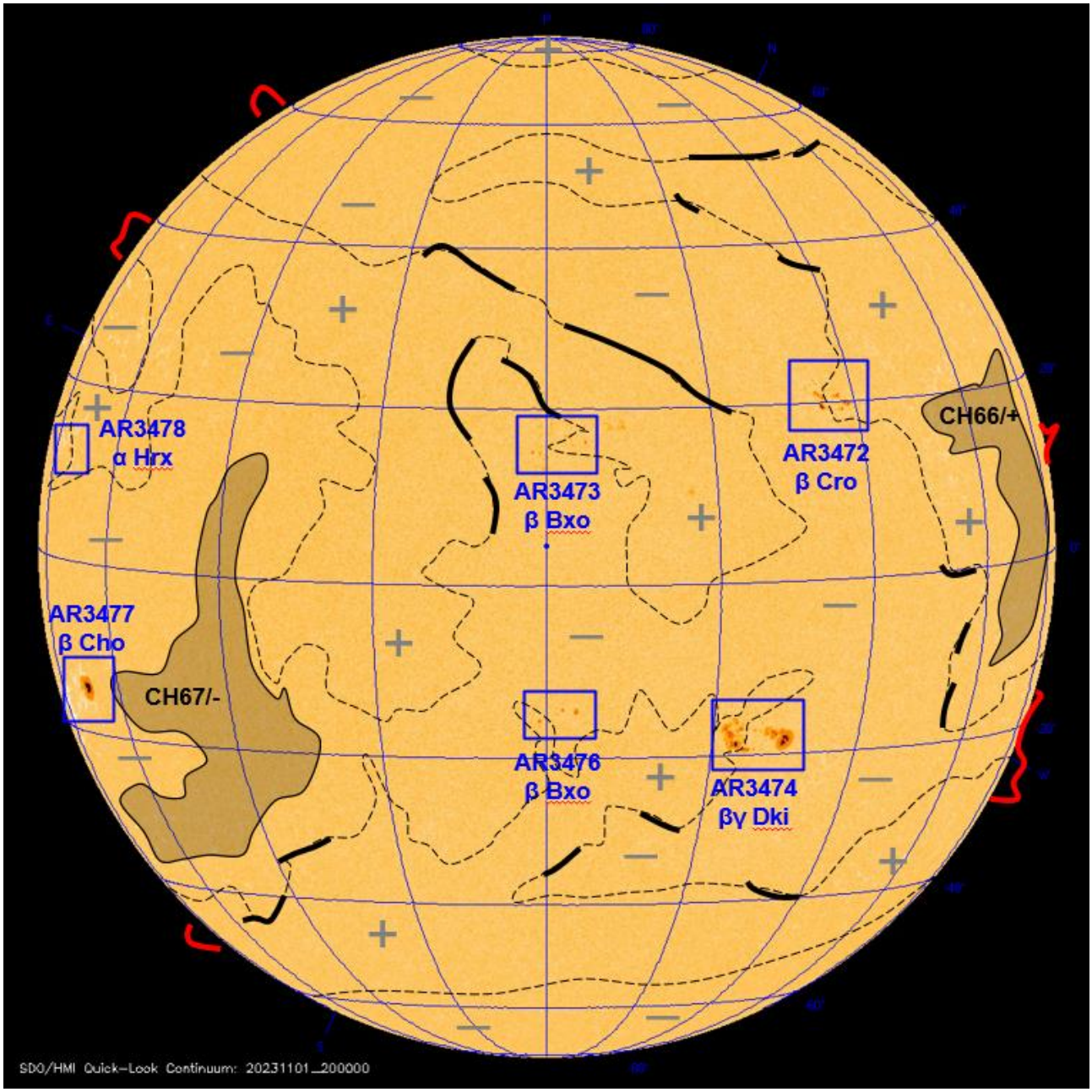
Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels. High energy electron flux (greater than 2MeV) is forecast to oscillate between mainly Moderate and High levels in the coming days, but with a decreasing day-on-day peak. Electron fluence values remain just below the Active (greater than 1e8 integrated pfu) threshold. There is a chance of reaching the Active threshold between days 1-2 (02-03 Nov) with the greatest likelihood of exceeding the Active threshold on day 1 (01 Nov). There is a gradual reduction in probabilities in the following days.

Figure 1. Solar Analysis Valid 01/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
A filament eruption from the southeast quadrant around 31/2200 UTC resulted in a CME that may give Earth a glancing blow either late day 3 (04 Nov) or early day 4 (05 Nov). No other Earth-directed CMEs presently feature in the forecast.

Solar wind speeds have declined to around 450km/s as the effects of the high speed stream from CH66/+ continue to ease. No significant transient or recurrent coronal holes are forecast to connect with Earth within the forecast period with winds expected to fall to background on day 1 (02 Nov).

Mainly Quiet geomagnetic activity is expected with a chance of isolated Unsettled intervals. Any arrival of the CME from late 31 Oct during the latter part of day 3 (04 Nov) or early day 4 (05 Nov) could see activity increase to Unsettled to Active levels.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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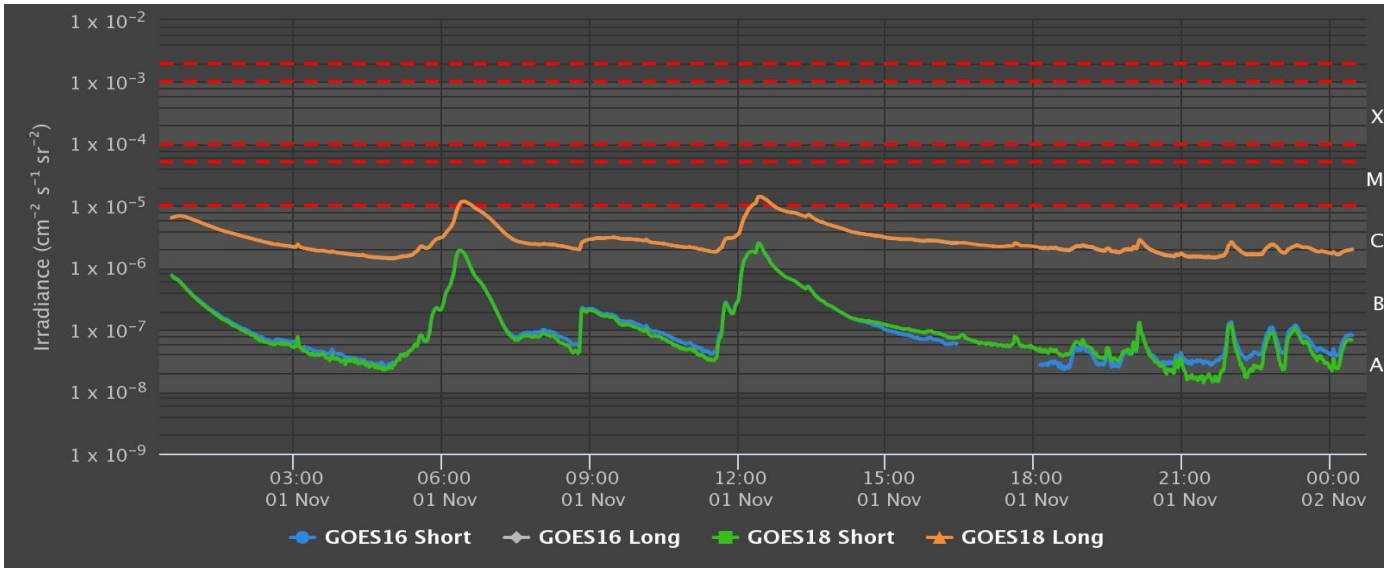
Radio Blackouts - X-Ray Flares:
There are six sunspots on the visible disc. AR3474 remains the largest group with a large lead and trailer spot and some smaller intermediate spots. The very small delta spot adjacent to the main trailer spot has now faded, but the region maintains some magnetic complexity given the large asymmetric trailer spot. AR3472 has seen the emergence of further small spots, and some consolidation of spots and penumbra developing within its trailer portion. The new sunspot region (Hrx/Alpha) rotating onto northeast limb has been numbered AR3478. All other regions appear largely unchanged at this time.

An M1.1 flare peaking at 01/0626 UTC is suspected to be from a region beyond the southeast limb. GONG far-sided seismic signatures suggest a notable region lies around a day from the eastern horizon and may present an uptick in flare risk in the coming days. Low to Moderate solar activity is forecast, with a chance of further isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: GOES X-Ray flares over the past 24 hours.



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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels, although there is a very slight chance of proton storms from AR3474 as it rotates into a more favourable location in the western hemisphere of the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is expected to continue to vary between Moderate and High levels initially due to the legacy of the high speed stream from CH66/+. A gradual day-on-day decrease in diurnal maxima is likely through the period, with more persistently background or Moderate levels expected by days 3 and 4 (04-05 Nov).

Electron fluence values remain just below the Active (greater than 1e8 integrated pfu) threshold. There is a chance of reaching the Active threshold between days 1-2 (02-03 Nov) with the greatest likelihood of exceeding the Active threshold on day 1 (02 Nov). There is a gradual reduction in probabilities in the following days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	50	30	10	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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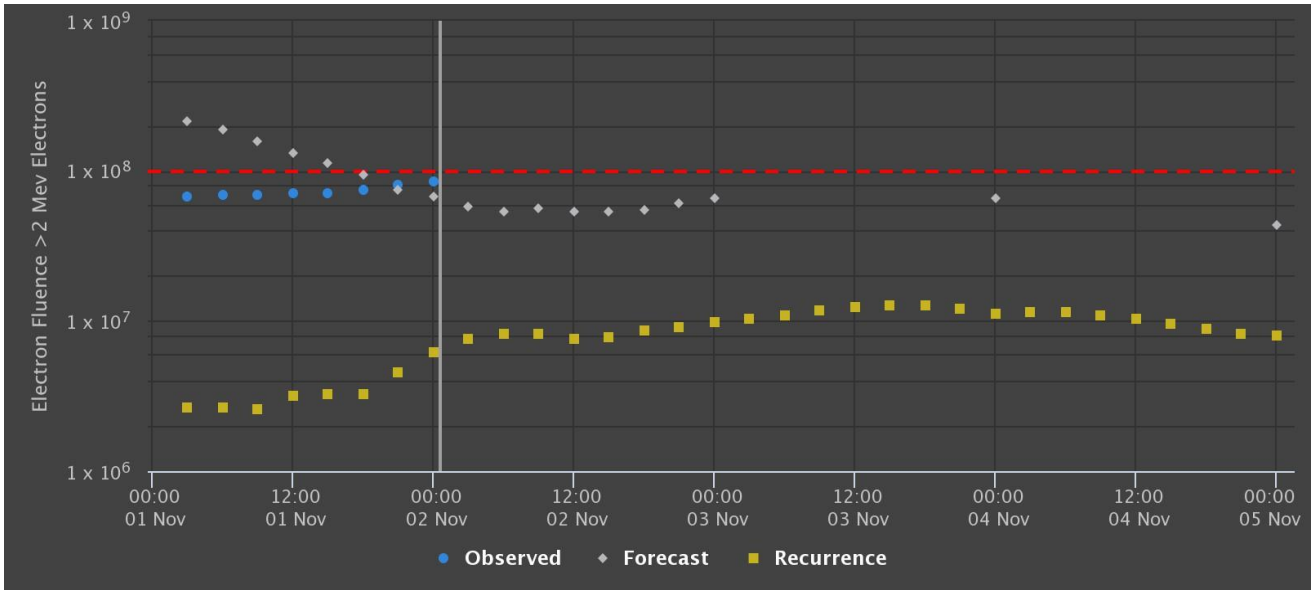
Figure 3: MOSWOC REFM electron fluence – observations and forecast.



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